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By Greg Miller

BIOETHIC: STUDENTS LEARN HOW, NOT WHAT, TO THINK ABOUT DIFFICULT ISSUES

A novel bioethics program trains teachers to help students confront challenges in the classroom--and in their lives

As a student, Rosetta Lee had mixed feelings about animal dissections. Now a science teacher, she gives her students the choice to opt out. That policy used to foster some unruly behavior in her classroom at Seattle Girls' School, a private middle school in downtown Seattle, Washington, where she's taught for 8 years. Those who chose not to dissect a chicken leg would often taunt their classmates with accusations of animal cruelty, whereas participants were "carelessly playful" and waved around pieces of chicken fat.

Not anymore. Thanks to a novel program that trains secondary school teachers in bioethics, Lee now prepares students with carefully guided classroom discussions exploring the potential benefits and harms of dissection. Lee can see the effect on her students: Those who choose to participate in the dissection are more studious and respectful, and those who abstain are less judgmental.

The program, sponsored by the Northwest Association for Biomedical Research (NWABR) and the University of Washington (UW), has taught Lee and other teachers how to help students think more critically about ethical issues inside and outside the classroom, such as the appropriate uses of genetic testing and the acceptability of stem cell research and genetically modified foods. That's an increasingly important skill, say science educators. "It would be a great thing for our society to have people who are more prepared to engage with these bioethical problems at that level," says Bruce Fuchs, director of the Office of Science Education at the U.S. National Institutes of Health (NIH) in Bethesda, Maryland. Teaching bioethics may even whet students' appetites for science itself, says Jeanne Ting Chowning, the director of the NWABR program and a former high school biology teacher. "Students often ask, 'Why do we have to learn this?' " Chowning says. "This is one way to show them ... why it's important to understand science."

Beyond gut feelings

Science teachers typically get very little guidance on how to approach bioethics, says Chowning. "A lot of biology textbooks give you a really interesting scenario

and maybe a few discussion questions and say, 'Discuss this with your class.' " That's a terrifying prospect for many teachers, Chowning says. "They're afraid it's just going to erupt into 'my opinion versus your opinion.' "



Serious play. Science teacher Jamie Cooke and Mercer Island (Washington) High School students use Play-Doh to model stem cells in a developing embryo as part of a class discussion.

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One of the first efforts to give teachers the tools they need was funded nearly 20 years ago by Roche Pharmaceuticals. Working with the Hastings Center, a bioethics research institute in Garrison, New York, the New Jersey Science Supervisors Association (NJSSA) developed a bioethics curriculum that includes case studies and classroom guides. Although the materials are still in use, much of it "was developed by ethicists who haven't been in a high school classroom since they themselves were in high school," says Lola Szobota, a district science supervisor in northern New Jersey who co-directs the NJSSA program and serves as an adviser to NWABR.

Chowning and colleagues wanted to build on that effort, which was restricted to New Jersey teachers. In 2003, they received a 5-year, \$1.5 million Science Education Partnership Award from the National Center for Research Resources, a component of NIH, to develop a primer and other materials for teachers and run summer training workshops. Last month, they received notice of a new grant for \$1.3 million, with the aim of developing additional materials and training for teachers and expanding the program's reach.

The primer (downloadable at www.nwabr.org/education/index.html) provides a step-by-step process for ethical decision-making. In Lee's class, that means helping her students identify the ethical question (to dissect or not to dissect); examine relevant facts about the planned lab, including what they might expect to learn from a dissection that they couldn't learn from a book; consider different perspectives; and weigh the possible courses of action.

Chowning and colleagues have also published curricula on stem cells and on HIV vaccine research, and there's one in the works on genetic testing for nicotine addiction risk in collaboration with UW's Department of Genome Sciences. The stem cell curriculum, for example, begins with a lesson on the biology of stem cells and a lab exercise in which students experiment with Planaria flatworms, whose stem

cells enable them to regenerate when cut into pieces. In later lessons, students delve into how scientists obtain embryonic and adult stem cells and discuss a case study in which a couple who conceived two children with in vitro fertilization has to decide the fate of their frozen embryos. The students finish the unit with a letter to the president with recommendations for government policy on stem cell research.

Each summer, about 25 teachers gather for a week at a rustic forest retreat on the eastern slope of Mount Rainier to practice strategies described in the ethics primer, develop case studies, and vet one another's work. "Last year, I came away from every session with something I could actually use in class, and that's not something I can say about any of the other [workshops] I've been to," says repeat attendee Tracy Watts, a teacher at Ontario High School in Ontario, Oregon. The NWABR program has also reached more than 2000 teachers through shorter workshops at national teacher conferences, Chowning says, and more than 500 teachers have downloaded materials for their Web site.

Teachers are free to adapt their training to fit their needs. Some, like Jamie Cooke, a science teacher at Mercer Island High School near Seattle, have developed entire courses on bioethics. The majority use it in smaller doses, incorporating a 2-week stem cell unit into a biology class, for example, or sprinkling bioethics lessons throughout an existing curriculum.

Cooke, who teaches in an affluent suburban district, says that bioethics appeals to college-bound students looking for a challenging science course as well as to those who just want to learn more about topics making news. At Kent-Meridian High School in Kent, Washington, an ethnically diverse and highly transient urban school where about 70% of the students qualify for government-subsidized lunches, biology teacher Jodie Mathwig uses movies and case studies as the basis for bioethics discussions that help engage students with little prior interest in science. "Stories where real people have difficult decisions to make really get the kids interested," she says. Often, Mathwig says, the students realize they need to understand biology before they can take a stand.

Like several other teachers, Lee says some parents asked her initially if she was "trying to teach values to my kid." But their concern vanished, says Lee, after she explained she was teaching students how to think through ethical dilemmas, not what to think about any given issue.

Meeting a need

The NWABR project is not the only effort to help teachers incorporate ethics discussions into their classes. The Kennedy Institute of Ethics at Georgetown University in Washington, D.C., maintains a free database of case studies and other materials (at highschoolbioethics.georgetown.edu), lends out videos, and does library research to find suitable materials for any teacher who requests them.

At the University of Utah in Salt Lake City, geneticist Louisa Stark oversees a genetics education Web site (teach.genetics.utah.edu/) with lesson plans on topics

such as gene therapy and personalized medicine and guides to discussing the ethical issues raised by these emerging biotechnologies. The Utah group also runs weeklong bioethics workshops for high school teachers and sessions at national conferences for science teachers.

A new project at the University of Pennsylvania (Penn) will help teachers tackle topics in neuroethics, such as potential forensic and military uses of brain-imaging technology and the care of patients in a persistent vegetative state (see hsneuroethics.org/). Funded by the Dana Foundation and led by bioethics graduate student Dominic Sisti, the program will supplement a high school bioethics project begun several years ago by Penn bioethicist Arthur Caplan. The group is developing a neuroethics primer and will run workshops for local teachers.

There seems to be both the demand and need for such efforts. Brian Shmaefsky, a board member of the National Association of Biology Teachers, says he's noticed a steady rise in the number of proposed bioethics workshops at NABT's annual meeting, as well as growing attendance at those workshops. Science standards released in 1996 by the U.S. National Academies make no explicit mention of bioethics, but they assert, for example, that students "need to take informed positions on some of the practical and ethical implications of humankind's capacity to manipulate living organisms." Most state standards include similar language, Chowning and others say.

Quantifying the impact of bioethics in the classroom is difficult, says Carolyn Cohen, a Seattle-based program evaluator. In a program assessment completed last month, Cohen found that about 90% of the teachers surveyed believe their students have a better understanding of the role of science in society as a result of the bioethics lessons they've received and that nearly 80% reported that students have become more aware of differing points of view. Slightly more than 60% reported improvements in students' scientific literacy and understanding of how scientific research is conducted. The teachers themselves feel better able to incorporate bioethics into their classes and do so more frequently. The new NIH grant includes funding for a more rigorous evaluation of students who have been taught bioethics and a comparable group that has not.



Fun with ethics. Jodie Mathwig (left) and Jacob Dahlke review lesson plans at a summer bioethics workshop for teachers.

CREDIT: JEANNE CHOWNING

Chowning says the NWABR program needs to become self-sustaining to make a lasting impact on educational practices. Toward that end, she has been developing an online version of the workshop--complete with video of experienced teachers in

the classroom, voice-over PowerPoint presentations, and other multimedia components--that teachers can enroll in through UW as part of ongoing professional development.

In the meantime, she hopes that students are acquiring the skills to make better decisions as adults. "They'll have to confront issues around genetic testing in their families, and they'll have to vote on issues like embryonic stem cell research," she says. "We need to make sure they're prepared for their future."